Communal Versus Individual Learning of a Math-Estimation Task: African American Children and the Culture of Learning Contexts

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ABSTRACT. The authors compared the performance of 78 African American 5th-grade students who studied a math-estimation task in one of two learning contexts. Learning contexts differed in the degree to which they afforded the expression of communalism. ANCOVA confirmed that posttest performance was best for students who studied in the high communal-learning context. The findings support A. W. Boykin’s (1994) contention that the cultural context of learning can be a critical mediator of children’s performance.

Key words: African American, at risk, cognitive development, communalism, cooperative learning, learning groups, math estimation, talent development

THE ACADEMIC PERFORMANCE OF AFRICAN AMERICAN STUDENTS continues to lag behind their European American counterparts despite ever-broadening efforts to alleviate the problem (National Center for Educational Statistics, 2001). Debate over what specific factors place African American students at risk for academic failure has intensified with the emergence of integrity-based models of academic achievement and cognitive development (Boykin, 1994; Ellison & Boykin, 1994). Integrity-based models reject the common notion that poor performance is related to a native inability among students or to their so-called impoverished home environments. Such models insist that students are endowed by their formative home and community experiences with attitudes and
behaviors that have salience, coherence, and integrity, and which educators must capitalize on and nurture toward high achievement. An increasing number of scholars working in this area stress the relationship between culture and cognitive development (Boykin, 1986, 1994; Rogoff & Chavajay, 1995) and in so doing have begun to change the discussion around African American students’ achievement difficulties.

Culture and Cognitive Development

Culture and cognitive development have been linked largely through the exploration of Vygotsky’s sociohistorical theory. According to contextualist scholarship that has emerged as an extension of sociohistorical theory, “to understand individual thinking, one needs to understand the social, cultural and historical context in which it is used” (Rogoff & Chavajay, 1995, p. 866). The contextualist view considers the separation of person and context artificial and distorting (Lave, 1996), because meaning is derived via “reciprocal interaction and joint construction by the individual and others in the social context.” According to Sivan, the process of reciprocal interaction “is the means by which the child grows intellectually and is socialized in appropriate use of objects, knowledge, tools and signs, in other words, culture” (1986, p. 211). This point, as related to cognitive development and education, is especially compelling when we acknowledge that the “essential curriculum” we wish for every child to learn in school is composed of objects, knowledge, tools, and signs of and within a culture.

Early empirical support for such thinking came as anomalies in the data of cross-cultural psychologists. Several researchers found that although people from non-Euro-Western cultures often did not immediately perform well on Western cognitive assessments, they showed evidence of the requisite skills expressed with reference to their own sensibilities about their own environments (Rogoff & Wadell, 1982; Scribner, 1977; Serpell, 1979). Those early findings spawned decades of research documenting the role of context and culture in cognitive development, a trend that continues today (Rogoff & Chavajay, 1995).

Psychology’s emerging understanding of the link between culture and cognition adds an important dimension to the study of cognitive development and schooling for it permits—actually demands—analysis of the interactions among

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differing cultures that exist in close proximity. Such an analysis is advanced by Boykin (1986), who asserts that the psychological orientations and behavioral inclinations of African Americans are informed by systems of meaning that are cultivated in their immediate home and community environments and that these systems of meaning are distinct from those that inform U.S. mainstream culture. According to Boykin, by remaining on the margin of U.S. society in important ways, whether by choice or by prohibition, African Americans have remained sufficiently insulated from the forces of enculturation to have retained fundamental aspects of their African cultural heritage (Abrahams & Szwed, 1983; Boykin, 1986). In general, the social systems that organize the immediate home and community life of African Americans are cohesive, meaningful, and have integrity and are not aberrations or incomplete forms of the dominant Eurofounded culture as is sometimes assumed.

Boykin and Allen (2000) describe how Afrocultural themes are appropriated early in development through participation in the culturally structured contexts of African American home and community life. Because these themes permeate the conditions for the development of and practice of emerging skills and competencies, they come to guide Black children’s behaviors, outlooks, and perspectives and so determine their behavioral and cognitive repertoires. Moreover, such themes take on developmental primacy and potency because they are linked to positive affect and significant others.

An important implication of this argument is that the inclusion of Afrocultural themes in learning contexts can support learning by providing opportunities for African American children to use existing competencies in the service of attaining new ones. Learning contexts that include familiar cultural themes are also more likely to sustain and enhance students’ motivation to engage in required tasks than contexts characterized by unfamiliar themes. A growing body of empirical data has substantiated these claims as related to the Afrocultural themes of verve (Bailey & Boykin, 2001; Boykin, Allen, & Davis, 1997), movement orientation (Allen & Butler, 1996; Boykin & Cunningham, 2001), and of interest here, communalism (Dill & Boykin, 2000).

The study by Dill & Boykin (2000), for example, examined the performance of African American fifth graders on a text-learning task. Participants studied the text in learning contexts that did or did not include elements of the communalism Afrocultural theme. After studying in one of three learning conditions described as communal, peer tutoring, or individual learning, participants individually completed a recall task. The authors reported that participants who studied in the communal learning context recalled significantly more text than those assigned to the peer tutoring or individual contexts. Studies that have included Black and White children have consistently reported interaction between cultural themes made part of the learning context and ethnicity (Albury, 1993; Allen & Butler, 1996; Boykin & Cunningham, 2001). Albury (1993), for example, found that European American students who studied in individualistic or competitive-
ly structured learning environments performed better on a vocabulary task than did those who studied communally.

Communalism in African American Culture

Several authors have identified communalism as an important theme in African American culture (Akbar, 1985; Boykin, 1986; Moemeka, 1998). Boykin (1986) described communalism as important among the cultural themes that mediate African American children’s learning. A communal orientation is marked by the priority of social bonds, awareness of interconnectedness among people, and a sense of mutual responsibility. The construct definition (Hurley, 1999) partitions the general concept into four subdimensions:

1. Social orientation: placing a premium on interactions and relationships with people rather than with objects or things;
2. Group duty: placing the concerns of the group first;
3. Identity: making group membership central to one’s self-identity;
4. Sharing: knowing that resources are rightfully shared rather than hoarded for individual benefit.

Communalism research is premised on the notion that, in general, African Americans’ formative home and community experiences are marked by a particular emphasis on interpersonal relationships, group identity formation, and a sense of shared responsibility that cultivates these tendencies in children’s thought and behavior. It is argued that incorporation of these themes into learning contexts can have facilitating effects on children’s learning and development and that the absence of these themes may undermine their learning by requiring them to function in contexts that are less familiar and perhaps alienating. Some of the earliest evidence of the role and relevance of communalism to Black children’s schooling emerged in the cooperative learning literature.

Decades of findings in the cooperative learning literature indicate that this method of instruction can have real benefits for learning (see reviews by Qin, Johnson, & Johnson, 1995; Slavin, 1983). Within that literature, a number of studies have concluded that African American students gain more under cooperative learning conditions than White students (Johnson & Johnson, 1985; Lucker, Rosenfield, Sikes, & Aronson, 1976; Slavin, 1979, 1983) and that they are more likely than their White counterparts to report satisfaction with the group interaction, enjoyment of the task, and liking their group members (Garibaldi, 1979).

In explaining these results, some authors have suggested that this orientation is an expression of culture (Kagan, Zahn, Widaman, Schwarzwald, & Tyrrell, 1985; Slavin 1983). Such postdictions, however insightful, lack a cohesive theoretical foundation or model with which to describe current data, predict future findings, or plan further, more illuminating research. Boykin and Allen’s (2000)
assertion that cultural themes are appropriated into the culture of Black children’s home and community life provides a much-needed framework around which to predict and interpret such findings.

Although many of the observations of Black children’s performance in cooperative learning conditions are interpretable with reference to the communalism Afro-cultural theme (Boykin, 1986), communalism and cooperative learning are theoretically and practically distinct. Perhaps the most important distinction is how communalism and cooperative learning are functionally conceived.

Cooperative learning theorists focus on working together as having procedural benefits to learning. These procedural benefits are thought to be unrelated to issues of motivation, which must be arranged separately. Cooperative learning models based in behaviorist thinking attend to motivation principally in terms of goal structure; those based in process theory seek to manipulate motivation through training, cohesiveness building, and other activities designed to “trick” students into cooperating (Johnson & Johnson, 1994; Slavin, Hurley, & Chamberlain, 2001). Communalism by contrast, is thought to be in and of itself motivation for group-centered behavior.

As operationalized for investigation, communal learning is most closely related to what is commonly known as “pure cooperation” in that students work together in groups and that no extrinsic manipulation of motivation is used. They are different in that the creation of a communal learning context involves the interplay of multiple elements toward what Boykin (1991) termed a functional confluence. Boykin used this term to describe how relatively simple elements of a context can be concerted to effectively support some modes of thinking and behavior over others, provided that the modes being privileged are part of the cognitive and behavioral repertoires of the participants. Indeed, a functional confluence of elements is also what supports the expression of individualism and competition in the majority of U.S. classrooms, including when cooperative learning methods are in use.

The associated empirical work has been consistent in demonstrating that African American students learn more and prefer learning contexts that support the expression of a communal orientation including the study by Dill and Boykin described earlier (2000) and others (see Boykin, Jagers, Ellison, & Albury, 1997, for a review). Albury (1993), for example, found that African American students’ performance on a vocabulary task was better for those who worked in communal groups than for those who worked in learning contexts that were individualized with a goal criterion or who worked in competition with other individuals. She also found that Black students’ performance in communal and reward-contingent cooperative conditions did not differ, lending credence to the notion that group work is more important to African American students than rewards per se. Albury also found that African American children who studied communally were more positive in their rating of affective variables, including liking for the study,
liking for members of their group, sharing ideas, and caring about members of the group.

Communal Learning and Mathematics

Thus far, communalism research has used language-based tasks. The work has yet to determine whether the familiarity invoked by incorporating cultural themes into learning contexts functions similarly across task types or whether these facilitating effects are uniquely tied to characteristics of the language tasks used to date. For this reason, in the current study we used a mathematics task.

The cooperative learning literature provides analogous evidence in a meta-analysis by Qin et al. (1995), the results of which showed that the superiority of cooperative learning was greater on nonlinguistic than on linguistic problems. It stands to reason that the facilitating effects of communal learning observed with linguistic tasks would extend to mathematics tasks. This likelihood is intriguing, because numeric competence is counted among the most fundamental aspects of cognitive development.

Mathematics was chosen for this work because of a need to generalize previous findings to other types of tasks. However, unlike the language-based tasks used in prior research, math skills in general tend to be cumulative. Prior knowledge can be a difficult confound to control. Computational estimation provides a convenient way to control for prior knowledge. Also called mental math, computational estimation requires students to consider questions about the relative magnitude of quantities. It requires students to generate inexact but reasonable solutions to math problems through mental manipulation of the quantities (rather than using written solution procedures that often do not require mental manipulation or conceptual understanding).

Computational estimation was chosen for this research because although the prerequisite skills are very basic and are emphasized in school, estimation itself is rarely taught. Most fourth graders will have attained and surpassed the prerequisite knowledge but will not have mastered estimation. LeFevre, Greenham, and Waheed (1993) found that few fourth graders could estimate, but that sixth and eighth graders provided reasonable estimates. Estimation is similarly unfamiliar, yet similarly accessible to students with a range of prior achievement.

Estimation skills are also relevant to important educational goals. To be mathematically numerate, one must understand both the actual and relative sizes of numbers (Sowder, 1992; Turkel & Newman, 1988). An inability to estimate with some competence can be considered symptomatic of a limited comprehension of numbers in general. Although computational estimation is a fundamental skill in mathematics and an underlying skill for many math problems on standardized tests, it is often neglected in classroom instruction (Spitzer, 1976; Vann, 1995).
In the present research, we sought to replicate, in part, previous investigations of the link between Afrocultural themes and Black children’s learning. In addition, we hoped to expand the generalizability of previous work to include mathematical concepts, specifically math estimation. Toward that end, students’ performances on an estimation task were assessed after they participated in one of two learning contexts that differed in the degree to which they afforded the expression of a communal orientation.

We predicted that, as in investigations using language-based tasks, African American students who studied in the learning context that afforded and encouraged the expression of communalism would perform better on the math estimation task than would those who studied in the learning context that did not encourage such expression.

Method

Participants

We chose the participants from two urban public schools in a northeastern U.S. city. The sample of 78 African American children included 45 boys and 33 girls in fifth grade who ranged in age from 9 years, 6 months to 10 years, 4 months. We selected only students whose academic performance and behavior fell within the middle 75% for their classrooms and schools. Teachers made this determination. The participating children were of relatively low socioeconomic status as determined by their schools’ participation in the Federal Title I program and by students’ participation in the free and reduced-lunch program at their respective schools.

Instruments and Manipulations

Study session materials. The study packet was an 11-page workbook designed to teach the basic concepts of the “nice number” estimation strategy (Reys, Reys, Trifon, & Zawojewski, 1985) through examples, activities, and narration. Nice numbers are numbers (such as 5, 10, 20, 100) that allow easy mental computation because they are easy to count with. The nice number computational estimation strategy involves rounding the numbers in a problem to the nearest nice number and then calculating mentally to make an estimate for the original equation. One example used in the math-estimation task designed for this research was $20 \times 97 = ?$

Using the nice number estimation strategy, one would round 97 to 100, mentally solve the simplified equation ($20 \times 100 = 2000$) and use the solution as an estimate for the original problem. The strategy was designed for students in grade levels 7 through 12, but, as reported, it is accessible to younger students.

The workbook format was designed from a survey of literature in mathematics instruction manuals for teachers and with input from active teachers
(Bordelon, personal communication, February, 1995; Hazekamp, 1986; Ockenga & Duea, 1985; Reys et al., 1985; Sauve, personal communication, February, 1995). All sources stressed the use of a verbal introduction, interesting examples, simple practice exercises, stimulating graphic presentation, and a review of the micro skills that undergird the target skills. The workbook begins by introducing and defining estimation with an example of its use. It then reviews important subskills, including counting by nice numbers (10, 20, 30, 40, 50) and basic multiplication leading up to easy and then more difficult estimation-in-multiplication exercises. By the time they have finished the workbook, students may be able to solve estimation problems in the format used for the experimental task.

Operationalization

The two experimental conditions were designed to differ in the degree to which the Afro-cultural theme of communalism (Boykin, 1994) was afforded and encouraged (high communal vs. low communal) during the learning phase. To achieve this difference, the study session for each condition differed by learning structure (group work vs. individual work), in the physical configuration of the context (sitting together using shared materials vs. sitting in individual desks with individual materials), in their reward structure (no reward vs. criterion reward), and in the type of motivational prompt (communal vs. individualistic).

In the high-communal learning context, the children worked together in groups of three. Students sat together at a table small enough for them to be in close proximity with one another and shared one set of materials. This was done to facilitate task interaction, sharing, and socialization. The study sessions in this condition included the communal prompt—a scripted statement intended to encourage the expression of communal over individualistic tendencies in students (Dill & Boykin, 2000). The experimenter sat with the students at the table to read the prompt. Each child was asked to hold hands with his or her neighbor on either side. The prompt reminded students that they were a group and that they should work hard and help each other by virtue of that fact and because of their common bond of school and community. The prompt stressed identification with their groups and the duty they had to each other. In emphasizing social contact, identification with and duty to group members and sharing, the high-communal learning context is designed to encourage the expression of communalism among students who participate in this learning context.

The children in the low-communal learning context studied alone in sets of three with individualized study materials. Students sat at individual desks that were separated to minimize the opportunity for them to interact with one another socially or on the task. The study sessions in this condition included the individualism prompt (Dill & Boykin, 2000), which is intended to reinforce the
expression of individualistic over communal tendencies in students. The experimenter stood near the students at their desks to read the prompt. The individualism prompt informed them that they could earn a reward if they improved their scores and that it is important to work hard on their own toward that goal. The prompt stressed individual effort, autonomy, and responsibility to self. The low-communal learning context is designed to afford relatively low levels of social contact and sharing. It emphasizes personal striving.

**Dependent Variables**

The dependent variable considered was posttest performance on the math-estimation task. The task consists of a short introduction to estimation and 15 estimation-in-multiplication problems presented in a multiple-choice format. Using the example cited earlier (20 × 97 =) (a) 21000, (b) 2000, (c) 4700, or (d) 3100, the correct choice (b) was generated using the nice number strategy. Incorrect choices were different in place value and number (a) or number (c and d) from the best choice. Pre- and posttests were the rotated split halves of a thirty-item test developed for this research. The two test forms were designated 1 and 2.

**Procedure**

Boys and girls were divided equally between the communal or individual conditions. Within gender, assignment to condition was random. Participants were then assigned to mixed-gender groups of three within their assigned condition. In addition, test–form order and the gender of the experimenter were counterbalanced across groups and conditions.

Each experimental session included one group of three participants. We pretested the groups of participants on one form of the math estimation task at individual desks before they participated in a 20-min study session. The study sessions began with the appropriate condition prompt and a brief introduction to and definition of math estimation. Students in the communal sessions shared one set of materials. Those in the individual sessions were given individual materials.

The experimenter remained present during the study session but did not participate. Because some participants were expected to demand interaction with experimenters beyond the instructions, experimenters were trained for appropriate limited interaction with the study groups. As additional insurance against inconsistent interaction with the groups, experimenters were also given a list of statements to guide their contact with the groups.

After the study session, we tested the participants on the equivalent form of the math estimation task at individual desks. Instructions for the posttest included a brief reinforcement of the condition prompt appropriate to their session.
Results

Preliminary analyses revealed that the mean pretest scores for the participants were better than expected by chance alone at 6.36, SD (3.50), or 42% correct. The children appeared to have some basic number competency if not prior experience with estimation. Pretest scores across learning conditions were similar at 6.51, SD (3.51), and 6.21, SD (3.47), for high- and low-communal learning contexts, respectively. They were also similar across gender groups at 6.11, SD (3.43), and 6.70, SD (3.55), for girls and boys, respectively.

We generated a 2 × 2 analysis of covariance (ANCOVA) with learning context (high-communal, low-communal) and gender (female, male) as factors and pretest scores as a covariate. Posttest performance was the dependent variable. Figure 1 depicts the relationship between pretest and adjusted posttest means for the high- and low-communal learning contexts. There was a main effect of learning condition on posttest performance, $F(1, 77) = 7.49, p < .01$, indicating that children in the high-communal learning condition ($M = 10.18, SD = 4.15$), or 67%, significantly outperformed those in the low-communal learning condition ($M = 7.59, SD = 3.66$), or 51%, on the posttest (ES = .57). There were no significant gender effects. Details of the ANCOVA are presented in Table 1.

![FIGURE 1. Math estimation pre- and posttest performance by learning condition.](image-url)
TABLE 1. Analysis of Covariance for Posttest Performance—Tests of Between-Subjects Effects

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>F</th>
<th>( \eta^2 )</th>
<th>p</th>
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</thead>
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<td>Pretest</td>
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<td>.09</td>
<td>.00</td>
<td>.76</td>
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<tr>
<td>Condition</td>
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<td>7.49</td>
<td>.09</td>
<td>.01</td>
</tr>
<tr>
<td>Gender</td>
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<td>2.37</td>
<td>.03</td>
<td>.09</td>
</tr>
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<td>.02</td>
<td>.00</td>
<td>.95</td>
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<tr>
<td>Error</td>
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<td>(15.42)</td>
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</tbody>
</table>

Note. Value in parenthesis represents mean square error.

Discussion

Albury (1993) and others (see for example, Dill & Boykin, 2000; Hurley, 1999) have found that African American students were more responsive to learning contexts with communal themes incorporated into their structure and instructions than to those into which individualistic themes had been incorporated. However, these previous investigations used language tasks exclusively. In the present study, we sought to extend the generalizability of that work to learning tasks in other domains. Toward that end, African American students studied a math estimation task in high-communal or low-communal learning contexts. The fact that the mean performance for students who studied in the high-communal learning contexts was better than that of their counterparts who studied in low-communal learning contexts supports our prediction that the finding of earlier studies would generalize to mathematics learning. Because the estimation task was presented in a format akin to those used in math classrooms, the finding is expected to have ecological validity and practical utility. These findings have clear implications for how educators go about teaching math to African American children. It suggests that with appropriate pedagogical accommodation, African American children’s communal orientation can be leveraged to their benefit in math classrooms.

More broadly, these findings support the notion that the configuration of the environment in which learning takes place is critical in determining how well and how much children learn. These data support the assertion that the incorporation of culturally familiar themes into learning contexts may facilitate students’ acquisition of new competencies by allowing them to function in familiar cognitive modes and by allowing them to build on existing competencies, in this case, their familiarity and facility with group interaction.

Such research needs to be advanced in at least two important directions. Concerning communalism, it remains unclear what African American students
perceive about communal learning that serves to enhance their motivation, liking, and performance. It is also unclear how they behave in communal learning contexts and how this behavior enhances their outcomes on the same variables. It is possible, for example, that the generally more interactive character of our communal learning contexts led students to feel more comfortable seeking and receiving assistance and or encouragement not only from group members but from the experimenters as well.

We trained our experimenters in appropriate limited interaction with the groups and equipped them with a list of standard phrases to use when students sought to interact with them. They were further instructed to respond to inquiries but not to initiate them and to keep their interactions with the groups brief. At the same time, we did not assess whether students in the high-communal groups demanded more contact than the other groups did. A finding that communal groups sought and received more encouragement would suggest mediation rather than provide a competing explanation for these findings. Nonetheless, such a mediation effect would be noteworthy because this line of research must begin to identify specific behaviors and attitudes that contribute to observed differences.

Although several other studies mentioned have demonstrated the interaction of ethnicity with the cultural configuration of learning contexts (Albury, 1993; Bailey & Boykin, 2001; Boykin & Cunningham, 2001), these math performance observations would benefit from a direct comparison across ethnic groups and learning contexts. Other sampling issues should also be explored. Future investigators would do well to consider variables such as a student’s cultural and ethnic identity and socioeconomic status. Including these variables would allow us to assess culture or class by condition interactions. Such comparisons would allow more precise observation of the cultural factors presumed to underlie performance effects like those found in this and other research.

These findings and others like them may play a role in guiding the discussion around the academic fate of African American children and all minority children for whom cultural issues may interact with their experiences in mainstream schools. The knowledge that educators can leverage the cognitive and behavioral competencies students bring to school toward their achievement is not particularly new. What these and similar data add to our understanding is a demonstration of the integrity and organization of the cognitive and behavioral orientations particular to African American culture that many Black children bring to school. Psychologists and educators have labored too long in the false certainty that solving Black children’s educational difficulties should best involve changing something about Black children. This work contributes to the mounting evidence that scholars and educators must learn to ask how can we change and broaden educational practice so that Blacks and all children’s talents can be developed.
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